APPENDIX F

RED BLUFF DIVERSION DAM PILOT PUMPING PLANT
BIOLOGICAL STUDIES

C-089653

RED BLUFF PILOT PUMPING PLANT BIOLOGICAL STUDIES *

1993 - 1998

GOALS AND OBJECTIVES - COMPILED BY C. LISTON

I. DETERMINE IF A MAJOR PUMPING PLANT AT RBDD CAN OPERATE WITH MINIMAL LOSS OR HARM OF DOWNSTREAM MIGRATING CHINOOK SALMON YOUNG

A. Determine survivorship and potential injury to young salmon in the present bypass system at RBDD under differing conditions that reflect seasonal and flow rate changes.

Time Frame: May, 1993 - November, 1994

B. Determine survivorship and potential injury to young salmon entrained into the Archimedes and screw-centrifugal pumps under differing conditions that reflect seasonal and flow rate changes.

Time Frame: January, 1995 - April, 1997

C. Determine the efficiency of recovering young salmon in the holding tanks following introduction of fish directly into the pump effluents; if less than 100 % recovery, determine where fish are remaining in the system and recommend and implement improvements.

Time Frame: January, 1995 - March, 1996

D. Determine survivorship and potential injury to young salmon exposed to the various structures of the fish evaluation facility including the immediate area receiving pump effluents, sluiceways, separation facilities with vertical angled screens, bypass channels upstream of the holding tanks, and the holding tanks, under differing conditions that reflect seasonal and flow rate changes.

Time Frame: January, 1995 - September, 1996

E. Determine residence time, survivorship, and potential injury of young salmon in the bypass pipe leading from the fish evaluation facility to the bypass outlet in the Sacramento River under flow rates expected with normal use of the fish evaluation facility, and under "pulsed" flows proposed for transporting fish to the bypass outlet.

Time Frame: January, 1995 - September, 1996

F. Determine movement and behavior of young salmon along trashracks, near openings to the pump barrels, and near the lower end of the Archimedes and screw centrifugal-type pumps using underwater video cameras and hydroacoustics.

Time Frame: November, 1994 - November, 1997

* **Biological study evaluations will be an adaptive management process which may lead to some modifications and changes as the studies progress. The studies are subject to funding availability.**

G. Determine predator-prey interactions between young salmon and Sacramento squawfish following passage of young salmon through the Archimedes and internal screw centrifugal pumps.

Time Frame: January, 1996 - June, 1997.

H. Develop an increased understanding of the timing and abundance of downstream migrating salmon in the Sacramento River near RBDD.

Time Frame: April, 1993 - February, 1998

I. Estimate seasonal and annual numbers of downstream migrating salmon young entrained into the RBPPP pumps by sampling holding tanks; determine viability of fish sampled from the holding tanks; determine seasonal and annual percentage of young Sacramento River salmon entrained.

Time Frame: January, 1995 - December, 1998

II. DETERMINE IF A MAJOR PUMPING PLANT AT RBDD CAN BE CONSTRUCTED AND OPERATED IN A MANNER THAT CREATES NO NEW ATTRACTION FOR FISH PREDATORS, AND, WHERE POSSIBLE, MINIMIZES FISH PREDATION NEAR STRUCTURES ASSOCIATED WITH THE PUMPING PLANT

Determine seasonal adult squawfish movements and behavior at RBPPP near RBDD through radiotracking techniques.

Time Frame: April, 1995 - May 1998

Determine seasonal relative numbers of predators near the trashracks and intake structure of RBPPP, and immediately below the bypass outlet in the Sacramento River; if predators increase through time, develop methods for removing or scattering predators.

Time Frame: March, 1994 - May, 1998

L. Determine the extent of predator colonization inside the intake sump area of RBPPP; if predators are residing in this area, develop methods to remove all predators.

Time Frame: May, 1995 - November, 1998

(Note: to accomplish objectives K and L above, considerable electrofishing and possibly netting will be done in the Sacramento River; with this, other species such as green and white sturgeon, catfish and American shad will be sampled and studied for any potential negative interactions between RBPPP and these species; focus will be on "native" species)

III. DETERMINE IF A MAJOR PUMPING PLANT AT RBDD COULD BE OPERATED WITH NO DELETERIOUS EFFECTS ON UPSTREAM SPAWNING MIGRATIONS FOR THE FOUR RACES OF SALMON AND STEELHEAD TROUT IN THE SACRAMENTO RIVER AT RBDD

M. Determine, through radiotracking, the seasonal and diel movement patterns of upstream migrating adult chinook salmon and steelhead trout near the operating RBPPP; if adult salmonid behavior is modified and upstream runs are negatively affected, provide recommendations for operational or structural changes at RBPPP.

Time Frame: January, 1995 - November, 1997

IV. DETERMINE IF AN EXPANDED PUMPING PLANT AT RBDD CAN BE OPERATED WITH NO HARM TO NATIVE SACRAMENTO RIVER FISH POPULATIONS FROM ENTRAINMENT OF LARVAE

N. Determine annual entrainment levels of larval and post-larval fishes in the RBPPP pumps; assess if entrainment rates limit populations of native Sacramento River fishes.

Time Frame: February, 1996 - August, 1997

V. PROVIDE A COMPLETE RECORD OF ENVIRONMENTAL AND ENGINEERING DATA OF IMMEDIATE USE TO ALL RESEARCHERS FOR INTERPRETING BIOLOGICAL DATA

O. Obtain and analyze records of frequent readings of water temperature, dissolved oxygen, pH, conductivity, turbidity, suspended sediments, river stage height, and river flow of the Sacramento River near the intake area of the RBPPP throughout the evaluation study; assure immediate access of data through computer technology to all RBPPP researchers.

Time Frame: May, 1994 - November, 1998

P. Obtain a continuous record of local atmospheric conditions including precipitation, barometric pressure, wind patterns and cloud cover throughout the evaluation study: assure immediate access of data through computer technology to all RBPPP researchers.

Time Frame: May, 1994 - August, 1998

C-089656